Course Syllabus

Department/Faculty: School of Engineering

Graduate Program: Materials Engineering and Nanotechnology

Degree
☒ Academic Master's ☒ Doctorate (PhD) ☐ Professional Master's

Course Name:
Mechanical Behaviour of Materials

Professor:
Prof. Dr. Antonio Augusto Couto

Office hours:
48

Course Overview:

Elastic behaviour and plastic deformation of materials. Dislocation theory and material strengthening mechanisms. Introduction to materials testing. General considerations on materials testing. Standardisation of materials testing. Importance of materials testing. Application of testing in materials engineering. Study of the main static mechanical tests: tensile, hardness, compression, torsion, bending, and flexural tests. Study of the main dynamic mechanical tests: impact, fracture toughness, and fatigue tests. Study of mechanical behaviour at elevated temperatures: high-temperature tensile testing and creep testing. Mechanical behaviour of polymeric materials. Mechanical behaviour of ceramic materials. Failure analysis due to mechanical causes in materials.

Topics outline:

1. Elastic behaviour
2. Plastic deformation
3. Static mechanical tests (tensile, compression, torsion, bending, flexural, hardness)
4. Dynamic mechanical tests (impact, fracture toughness, J-integral, fatigue)
5. Mechanical behaviour at elevated temperatures (creep)
6. Mechanical behaviour of metallic materials
7. Mechanical behaviour of polymeric materials
8. Mechanical behaviour of ceramic materials
9. Failure analysis due to mechanical causes

Letter Grade Assignment:
Grade A (Excellent) - Grade points between 9 and 10
Grade B (Good) - Grade points between 8 and 8.9
Grade C (Satisfactory) - Grade points between 7 and 7.9
Grade D (Unsatisfactory) - Grade points between 0 and 6.9

Texts, Materials, and supplies

Basic Bibliography:

ANDERSON, T. L. *Fracture Mechanics: fundamentals and applications*. 3 ed. Boca Raton: Taylor & Francis, 2005.

HERTZBERG, R. W. *Deformation and Fracture Mechanics of Engineering Materials*. 4 ed. New York: John Wiley & Sons, 1996.

JANSSEN, M.; ZUIDEMA, J.; WANHILL, R. J. H. *Fracture mechanics*. New York: Spon Press, 2004.

JONES, D.R.H. (Ed.). *Failure Analysis Case Studies II*. USA: Pergamon, 2001.